

## Role of Yoga in Chronic Kidney Disease: A Hypothetical Review

Kashinath GM\*, Hemant B, Praerna C, Nagarathna R and Nagendra HR

Division of Yoga and life sciences, Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA University), Bangalore, India

\*Corresponding author: Kashinath G Metri, Division of Yoga and life sciences, # 19 ekanath bhavan, Gavipuram Circle, K G Nagar Bangalore, India, Tel: +919035257626; E-mail: [kgmhetre@gmail.com](mailto:kgmhetre@gmail.com)

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### Abstract

Chronic kidney disease (CKD) is a medical condition characterized by progressive renal dysfunction which leads to permanent renal impairment and premature mortality, which affects patient's quality of life significantly. Diabetes, hypertension and glomerulo-nephritis are known to be the most common causes of CKD. Recent studies have reported that there is a strong association of oxidative stress, chronic inflammation and psychological stress with CKD. These factors significantly affect the treatment outcome in CKD. Treatment modalities which control these factors can contribute significantly towards CKD management.

Yoga is an ancient traditional science which encompasses yogic physical postures (*asanas*), yogic breathing practices (*pranayama*), meditations and relaxation techniques. Several scientific studies have shown that yoga reduces blood pressure, heart rate, respiratory rate, oxidative stress, psychological stress and inflammatory conditions. It also improves heart rate variability by bringing balance in autonomic nervous system by reducing sympathetic tone and increasing parasympathetic activity. In several studies, it has been reported that yoga has significant role in the management of non-communicable diseases like diabetes, hypertension, coronary heart diseases etc. Regular yoga practice can help control sugar levels in diabetics, blood pressure in hypertensives and reduce the risk of cardiac complications in patients with heart diseases. Thus, yoga has promising role in the primary and secondary management of CKD as an adjuvant. Here, we compile all these researches and based on this present a yoga module useful in CKD along with necessary precautions to be taken while doing yoga.

**Keywords:** Chronic Kidney Disease; Yoga module; Oxidative stress; Sympathetic tone; inflammatory markers

### Introduction

Chronic kidney disease (CKD) is a global health problem, with adverse outcomes of kidney failure, cardiovascular disease (CVD), and premature death. CKD is defined as kidney damage or glomerular filtration rate (GFR)  $<60$  mL/min/1.73 m<sup>2</sup> for 3 months or more, irrespective of cause [1]. It is a common and serious problem that adversely affects patient's health, quality of life, limits life span and increases economical burden to health-care systems worldwide [2]. In a survey by American Medical Society of Nephrology, it was estimated that more than 10% of adults in the United States, which amounts to more than 20 million people, may have CKD. Chances of occurrence of CKD increase after 50 years of age and are most common among adults older than 70 years [3]. Diabetes, hypertension and glomerulo-nephritis are known to be the most common causes of CKD and among these diabetes and hypertension are the leading causes of end stage renal disease (ESRD) [4]. In 2011, diabetes or hypertension was listed as the primary cause for 7 of 10 new cases of ESRD in the United States [4]. Several studies have demonstrated that there is an association of metabolic syndrome (high blood pressure, high serum triglyceride level, elevated fasting glucose level and central obesity) with CKD [5]. CKD further leads to co-morbidities such as hypertension, congestive heart failure, dyslipidemia, and anemia of chronic renal failure [6].

In this review, some important risk factors for CKD such as sympathetic tone [7], oxidative stress [8], chronic inflammation [8]

and psychological stress [9] have been highlighted and possible role of yoga in management of CKD through modifications of these risk factors have been postulated.

### Oxidative Stress and CKD

Oxidative stress is potential risk for mortality and morbidity in patient with CKD. Several studies have demonstrated the association of oxidative stress with CKD Particularly in ESRD (End Stage renal Disease) which is mainly because of reduce antioxidant system and increased pro-oxidant activity [10]. Oxidative stress increases as CKD progress [11], it worsens the CKD and in long run oxidative stress leads to cardiovascular related complications in CKD [12]. Apart from traditional risk factors, chronic inflammation, oxidative stress, malnutrition and endothelial dysfunction are important in CVD development in renal patients [13].

### Inflammatory Markers in CKD

CKD is characterized by low grade inflammation [14]. Recent scientific studies have demonstrated that CKD patients have elevated level of inflammatory markers. These inflammatory markers are C-reactive protein, IL-6, IL-10 etc., which worsen CKD and hamper the treatment outcome [15]. Inflammation in CKD also increases chances of atherosclerosis [16].

### Higher Sympathetic Tone and CKD

Researches show that higher sympathetic tone is potentially involved in progression of CKD and higher rate of cardiovascular

events in CKD patients [17]. It also promotes the development of target organ damage [18]. There is growing evidence that an important cause of the defect in renal excretory function in hypertension is an increase in renal sympathetic nerve activity [19].

## Psychological Stress and CKD

Sedentary lifestyle and psychological stress are considered as important contributors to non-communicable diseases. Frequent hospitalization, economic conditions, worry about treatment outcome, physical disability, poor family support are common sources of psychological stress in CKD patients. Depression is considered as one of the most common psychological condition in end-stage renal disease (ESRD) which leads to anemia and malnutrition by reducing the oral intake in chronic dialysis patients [15]. In a study, 24% patients on dialysis were having depression and these patients had significantly lower hemoglobin, hematocrit and serum albumin levels and higher C-reactive protein and ferritin levels [20]. Another cross-sectional study reported that patient with ESRD with depression had 2.95 fold more mortality than those without depression [21]. Number of studies show that psychological stress increases oxidative stress [22] and blood pressure, which further worsens CKD condition and treatment outcome. Hence, stress management should be considered in the management of CKD.

## Quality of life in CKD

Health-related quality of life (QOL) is an important measure of how disease affects patients' lives. New inventions in modern medical science has increased the life expectancy of patients having chronic disorders such as diabetes, cardiac disease, hypertension and cancer, but at the same time, unfortunately, it failed to improve the quality of life in these patients. This fact is especially true for patients with CKD who are on dialysis [23]. Anemia, pain, depression, anxiety and other comorbidities of CKD further hamper the quality of life of patients [24].

## Yoga

Yoga is an ancient traditional science which encompasses yogic physical postures (asanas), yogic breathing practices (pranayama), meditations and relaxation techniques. In present era Yoga is accepted as science rather than religion or philosophy. Yoga advocates individual existence in five dimensions and not merely physical. These five dimensions are annamaya kosha (physical body), pranamaya kosha (vital body), manomayakosha (Psychic body), vijanamayakosha (intellectual body) and anandamayakosha (causal body). According to Yoga philosophy, non-communicable diseases are the result of imbalance that starts at manomayakosha level and percolates down to the annamaya kosha level via pranamaya kosha, over a period of time. Therefore, yoga therapy focuses on bringing balance at all these levels of existence through various techniques. Its components such as asanas work at physical level, pranayama works at vital energy level and meditation works at psychological and intellectual levels. Recent evidences show that yoga reduces heart rate, blood pressure and basal metabolic rate by reducing sympathetic activity [25]. It has beneficial effect in many non-communicable diseases such as hypertension, diabetes and cancer. Yoga brings balance in autonomic nervous system by reducing the sympathetic tone and increasing parasympathetic tone [26]. Yoga has also been proven to produce various psychological benefits by reducing stress, anxiety and depression and improving the

quality of life [27]. Hence yoga is a comprehensive approach to the complex problem of non-communicable diseases like CKD.

## Yoga and Sympathetic Tone

Growing evidences suggest that yoga reduces pulse rate, systolic and diastolic blood pressure, basal metabolic rate by reducing sympathetic tone and improving the parasympathetic tone in non-communicable diseases. It reduces systolic, diastolic and mean blood pressure in the patients with hypertension [28]. Yoga reduces fasting, post-prandial, HbA1c sugar levels, cholesterol in diabetics [29]. Thus, yoga may help in prevention of CKD in patients of diabetes and hypertension which are known to be the main causes of CKD.

## Yoga and psychological stress

Many scientific studies have shown that yoga significantly reduces psychological stress in several physical and psychological ailments [30]. In a study, practice of Hath yoga showed significant reduction in perceived stress and negative effect [31]. In another RCT, there was significant improvement in stress, anxiety and health status compared to relaxation following yoga [32]. Yogic practices inhibit the areas responsible for fear, aggressiveness and rage, and stimulate the rewarding pleasure centers in the median forebrain and other areas leading to a state of bliss and pleasure. This inhibition results in lower anxiety, heart rate, respiratory rate, blood pressure, and cardiac output in students practicing yoga and meditation. Thus it improves the subjective wellbeing and quality of life [33]. Thus, yoga has significant role to play in management of stress related to CKD.

## Yoga and Oxidative stress

In a study, Hath yoga practice lead to significant improvement in anti-oxidant status and reduced oxidative stress levels in the patients with diabetes [34]. In another study, with 3 months follow up of yoga, there was reduced oxidative stress, BMI and glucose levels in the patients with diabetes type 2 [28]. A systematic review concluded that yoga may reduce many risk factors for CVD including oxidative stress, may improve clinical outcomes, and aid in the management of CVD and other insulin resistance syndrome (IRS) related conditions [35].

## Yoga and CKD

In a study on patients with CKD (ESRD) who were on dialysis, it was found that 30 minutes of hath yoga practice daily for 4 months showed significant reduction in oxidative stress (malondialdehyde, protein oxidation, phospholipase A2 activity) and increase in anti-oxidant activity (superoxide dismutase and catalase activities). This study demonstrated therapeutic, preventative as well as protective effects of Yoga in ESRD through reduction of oxidative stress [36]. Another study in end stage renal disease patients reported that yoga reduces cholesterol levels [37]. In another randomized controlled study on hemodialysis patients, 12 week yoga intervention yoga has proven to be safe and significantly effective in managing the pain, fatigue, sleep disturbance along with significant improvement in hand grip, significant reduction in creatinine, blood urea, alkaline phosphatase and cholesterol along with significant improvement in erythrocyte and hematocrit count [38]. Yoga therapy has been shown to increase haemoglobin levels in anemic patients [39], it may also help in improving the Hb% in CKD patients. In another recent study, 10 days Mindfulness-based stress reduction program reported

beneficial effect in improving quality and duration of sleep. It was concluded that it has the potential of being an effective, accessible and low-cost intervention that could significantly change transplant recipients' overall health and well-being [40]. Mindfulness meditation also reduced arterial blood pressure by reducing the sympathetic over activity in the chronic kidney disease [41]. Meditation also improved the quality of life and sympathetic over activity in Lupus Nephritis Patients with Chronic Kidney Disease [42].

## Yogic Practices for CKD

Depending on the researches done so far, following yogic practices (45 min/day twice a week for 3 months) are useful as an adjuvant to conventional therapies in CKD [37-42]:

(1) Physical postures done with awareness (*āsanas*; 1 minute each, total ~ 10-minute session) to be performed as follows:

Standing *āsanas*—Mountain posture with arms stretched up (*TadasanaUrdhvaHastasana*) and with bound hands (*TadasanaUrdhvaBaddhaHastasana*) Hand-to-foot pose (*Pādahastāsana*), and Half-waist-rotation pose (Ardha Kati Chakrāsana).

Sitting *āsanas*—Extension of the front body (*Purvottānāsana*), Hare pose (*Shashānkāsana*), Seated twist (*Bharadvājāsana/Vakrasana*), Butterfly (*Tittalāsana*)

Supine *āsanas*—Reclining bound angle posture (*Supta Baddhakonasana*),

Reclining cross legged posture (*Supta Svastikāsana*), Bridge pose (*Setubandhāsana*), Shoulder stand on a chair (*Salamba Sarvāngāsana*), Inverted lake pose (*ViparitaKarani*), Air releasing pose (*pavanmuktāsana*), Corpse posture (*Savāsana*) with bolster support under chest.

(2) Breathing techniques7 *Prānāyāma*, total ~ 10-minute session)- Hands in and out breathing (10 rounds in 2 minutes), hand stretch breathing (10 rounds in 2 minutes), tiger breathing (10 rounds in 2 minutes), alternate nostril breathing (*Nādisuddhi*; in 5 minutes), left nostril breathing (Chandra *AnulomaViloma*; 27 rounds in 5 minutes, 4 times per day), humming bee breath (*Bhramarī*; in 2 minutes), Cooling pranayama (*Sitalī*; 9 rounds) and abdominal breathing in lying-down position in 2 minutes.

(3) Yogic relaxation techniques with imagery or mindfulness based stress reduction for 20 minutes at the end of *āsanas* and *prānāyamas*.

(4) Meditations—Mindfulness meditation, Om Meditation, cyclic meditation and Yogic Counselling for 20 minutes.

## Yogic Practices to be avoided in CKD

Few components of yoga such as complete inverted poses like head stand pose (*sirsāsana*), fast breathing practices of *kapalabhati* and *bhastrika* should be avoided as they are known to increase the sympathetic activity and raise blood pressure. Apart from it, yogic cleansing procedure of *laghushankha praskhalana* and *vaman dhauti* should be avoided as it may precipitate electrolyte imbalances and increase the load on kidneys. Practice of yoga in conditions like CKD is advisable under medical supervision only.

## Conclusion

Yoga being non-invasive, cost-effective therapeutic intervention works at physical and psychological levels. It is effective intervention to reduce the blood pressure, heart rate and inflammatory markers both in healthy individuals and in patients with chronic diseases. Hypertension and diabetes are well known risk factors for CKD. Yoga helps in maintaining the blood sugars, blood pressure and lipid levels in these conditions. Yoga has also been proven to reduce oxidative stress, sympathetic tone, psychological stress and inflammatory markers in chronic diseases. These risk factors hamper treatment outcome of CKD. Yoga reduces general symptoms like fatigue, pain associated with CKD it also improves the hematocrit levels. Hence yoga has potential role as an adjunct in prevention and management of CKD. Further RCTs are needed to explore the role of yoga in CKD. Yoga should be administered with caution under the guidance of an expert as there are some practices which may worsen the condition.

## References

1. Levey AS, Eckardt KU, Tsukamoto Y, Levin A, Coresh J, et al. (2005) Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int* 67: 2089-2100.
2. Small DM, Coombes JS, Bennett N, Johnson DW, Gobe GC (2012) Oxidative stress, anti-oxidant therapies and chronic kidney disease. *Nephrology (Carlton)* 17: 311-321.
3. Smith DH, Gullion CM, Nichols G, Keith DS, Brown JB (2004) Cost of medical care for chronic kidney disease and comorbidity among enrollees in a large HMO population. *J Am Soc Nephrol* 15: 1300-1306.
4. Center for Disease control and prevention, CDC 24/7, National Chronic Kidney Disease Fact Sheet, 2014. Division of Diabetes Translation.
5. Li Y, Chen Y, Liu X, Liang Y, Shao X, et al. (2014) Metabolic Syndrome and Chronic Kidney Disease in a Southern Chinese population. *Nephrology*.
6. Keith DS, Nichols GA, Gullion CM, Brown JB, Smith DH (2004) Longitudinal follow-up and outcomes among a population with chronic kidney disease in a large managed care organization. *Arch Intern Med* 164: 659-663.
7. Schlaich MP, Socratous F, Henneby S, Eikelis N, Lambert EA, et al. (2009) Sympathetic activation in chronic renal failure. *J Am Soc Nephrol* 20: 933-939.
8. Cachofeiro V, Goicochea M, de Vinuesa SG, Oubiña P, Lahera V, et al. (2008) Oxidative stress and inflammation, a link between chronic kidney disease and cardiovascular disease. *Kidney Int Suppl*: S4-9.
9. Wright RG, Sand P, Livingston G (1966) Psychological stress during hemodialysis for chronic renal failure. *Ann Intern Med* 64: 611-621.
10. Locatelli F, Canaud B, Eckardt KU, Stenvinkel P, Wanner C, et al. (2003) Oxidative stress in end-stage renal disease: an emerging threat to patient outcome. *Nephrol Dial Transplant* 18: 1272-1280.
11. Dounousi E, Papavasiliou E, Makedou A, Ioannou K, Katopodis KP, et al. (2006) Oxidative stress is progressively enhanced with advancing stages of CKD. *Am J Kidney Dis* 48: 752-760.
12. Ghiadoni L, Cupisti A, Huang Y, Mattei P, Cardinal H, et al. (2004) Endothelial dysfunction and oxidative stress in chronic renal failure. *J Nephrol* 17: 512-519.
13. Annuk M, Soveri I, Zilmer M, Lind L, Hulthe J, et al. (2005) Endothelial function, CRP and oxidative stress in chronic kidney disease. *J Nephrol* 18: 721-726.
14. Yilmaz MI, Carrero JJ, Axelsson J, Lindholm B, Stenvinkel P (2007) Low-grade inflammation in chronic kidney disease patients before the start of renal replacement therapy: sources and consequences. *Clinical Nephrology*, 68: 1-9

15. Oberg BP, McMenamin E, Lucas FL, McMonagle E, Morrow J, et al. (2004) Increased prevalence of oxidant stress and inflammation in patients with moderate to severe chronic kidney disease. *Kidney Int* 65: 1009-1016.
16. Srinivasan Beddhu, Paul L, Kimmel, Nirupama Ramkumar, Alfred K. Cheung. Associations of Metabolic Syndrome With Inflammation in CKD: Results From the Third National Health and Nutrition Examination Survey (NHANES III). *American Journal of Kidney disease*. 46: 577-586.
17. Schlaich MP, Socratous F, Hennebry S, Eikelis N, Lambert EA, et al. (2009) Sympathetic activation in chronic renal failure. *J Am Soc Nephrol* 20: 933-939.
18. Grassi G, Bertoli S, Seravalle G (2012) Sympathetic nervous system: role in hypertension and in chronic kidney disease. *Curr Opin Nephrol Hypertens* 21: 46-51.
19. DiBona GF (2002) Sympathetic nervous system and the kidney in hypertension. *Curr Opin Nephrol Hypertens* 11: 197-200.
20. Kalender B, Ozdemir AC, Koroglu G (2006) Association of depression with markers of nutrition and inflammation in chronic kidney disease and end-stage renal disease. *Nephron Clin Pract* 102: c115-121.
21. Young BA, Von Korff M, Heckbert SR, Ludman EJ, Rutter C, et al. (2010) Association of major depression and mortality in Stage 5 diabetic chronic kidney disease. *Gen Hosp Psychiatry* 32: 119-124.
22. Rahman MM, Ichihayashi T, Komiyama T, Sato S, Konishi T (2008) Effects of anthocyanins on psychological stress-induced oxidative stress and neurotransmitter status. *J Agric Food Chem* 56: 7545-7550.
23. Mujais SK, Story K, Brouillette J, Takano T, Soroka S, et al. (2009) Health-related quality of life in CKD Patients: correlates and evolution over time. *Clin J Am Soc Nephrol* 4: 1293-1301.
24. Rachel LP, Fredric O, Finkelstein, Lei Liu, Erik Roys, Margaret Kiser, et al. (2005) Quality of life in Chronic Kidney Disease (CKD): A cross-sectional analysis in the Renal Research Institute-CKD study. *American Journal of Kidney Diseases*, 45: 658-666.
25. Schell FJ, Alolio B, Schonecke OW (1994) Physiological and psychological effects of Hatha-Yoga exercise in healthy women. *Int J Psychosom* 41: 46-52.
26. Streeter CC, Gerbarg PL, Saper RB, Ciraulo DA, Brown RP (2012) Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Med Hypotheses* 78: 571-579.
27. Berger B, Owen D (1988) Yoga, and Stress Reduction and Mood Enhancement in Four Exercise Modes: Swimming, Body Conditioning, Hatha Yoga, and Fencing. *Research Quarterly for Exercise and Sport*, 59: 148-159.
28. Innes KE, Bourguignon C, Taylor AG (2005) Risk Indices Associated with the Insulin Resistance Syndrome, Cardiovascular Disease, and Possible Protection with Yoga: A Systematic Review. *The Journal of the American Board of Family Medicine*, 18: 491-519.
29. Patel C (1975) 12-month follow-up of yoga and bio-feedback in the management of hypertension. *Lancet* 1: 62-64.
30. Schell FJ, Alolio B, Schonecke OW (1994) Physiological and psychological effects of Hatha-Yoga exercise in healthy women. *International Journal of Psychosomatics*, 41: 46-52.
31. West J, Otte C, Geher K, Johnson J, Mohr DC (2004) Effects of Hatha yoga and African dance on perceived stress, affect, and salivary cortisol. *Ann Behav Med* 28: 114-118.
32. Smith C, Hancock H, Blake-Mortimer J, Eckert K (2007) A randomised comparative trial of yoga and relaxation to reduce stress and anxiety. *Complement Ther Med* 15: 77-83.
33. Woodyard C (2011) Exploring the therapeutic effects of yoga and its ability to increase quality of life. *Int J Yoga* 4: 49-54.
34. Gordon LA, Morrison EY, McGrowder DA, Young R, Fraser YT, et al. (2008) Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. *BMC Complement Altern Med* 8: 21.
35. Hegde SV, Adhikari P, Kotian S, Pinto VJ, D'Souza S, et al. (2011) Effect of 3-month yoga on oxidative stress in type 2 diabetes with or without complications: a controlled clinical trial. *Diabetes Care* 34: 2208-2210.
36. Gordon L, McGrowder DA, Pena YT, Cabrera E, Lawrence-Wright MB (2013) Effect of yoga exercise therapy on oxidative stress indicators with end-stage renal disease on hemodialysis. *Int J Yoga* 6: 31-38.
37. Gordon L, McGrowder DA, Pena YT, Cabrera E, Lawrence-Wright M (2012) Effect of exercise therapy on lipid parameters in patients with end-stage renal disease on hemodialysis. *J Lab Physicians*, 4: 17-23.
38. Yurtkuran M1, Alp A, Yurtkuran M, Dilek K (2007) A modified yoga-based exercise program in hemodialysis patients: a randomized controlled study. *Complement Ther Med* 15: 164-171.
39. Ramanath B, Tajuddin Shaik, Somasekhar M (2013) A randomized control study of yoga on anemic patients. *International Journal of Research in Medical Sciences*. *Int J Res Med Sci*. 1: 240-242.
40. Kreitzer MJ, Gross CR, Ye X, Russas V, Treesak C (2005) Longitudinal impact of mindfulness meditation on illness burden in solid-organ transplant recipients. *Prog Transplant* 15: 166-172.
41. Jeanie Park, Susan BW (2013) Mindfulness meditation lowers blood pressure and sympathetic activity in hypertensive patients with chronic kidney disease *The FASEB Journal*. 27: 1118-1141.
42. Sirawit B, Wattana W, Pongpetch H, Somruedee C, Nuttasith L, et al. (2014) Role of Meditation in Reducing Sympathetic Hyperactivity and Improving Quality of Life in Lupus Nephritis Patients with Chronic Kidney Disease. *Journal of the Medical Association of Thailand*. 97(3)